



# Pacific Island Network News

Newsletter of the  
Pacific Island Network  
Inventory & Monitoring Program  
Jul.-Sept. 2006, Issue no. 05

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Often overlooked, but important resources, Jadlyn Moniz-Nakamura tells us about these dark crevices.

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Endangered silverswords at Haleakalā National Park.

Aloha. Talofa. Hello. Tirow.  
Hafa adai.

Picture a group of national parks spread out over an area larger than the continental U.S.? Now can you imagine a place where a vast sea fantastically collides with mountains and beaches to create tiny ecosystems inhabitable by man, plant, and beast? There is such a place, and it's called the Pacific Island Network (PACN). This network is unique in the National Park Service (NPS) as it is exclusively comprised of tropical islands and archipelagoes including protected areas in Hawaii, American Samoa, Guam, and the Northern Mariana Islands. Dive in and enjoy this edition of news briefs and stories in the National Park Service's Pacific Island Network.



Photo by M. Hart

## NEW PUP IN TOWN !



On the beach in Kalaupapa National Historical Park (KALA), this day-old endangered Hawaiian Monk seal pup was born. Nuzzling up to her mother whose tags indicate that she is originally from Oahu, this new family has found safety and shelter on the quiet shores of this special protected area of Hawaii. Five pups were born at KALA this year.



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The National Park Service has implemented natural resource inventory and monitoring on a servicerwide basis to ensure all park units possess the resource information needed for effective, science-based management, decision-making, and resource protection.

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# Board of Directors Note

## Sarah Creachbaum, Superintendent - WAPA & AMME

I have spent a career applying for work in seemingly far away places across the country. Last December, when I received the news of my selection as Superintendent of War in the Pacific National Historical Park (WAPA) on Guam, far away took on a new meaning.

Like many people who work in environmental sciences, my knowledge of Guam's ecology was limited to this singular detail: that nearly all the native bird species had been extirpated (never a good sign). Likewise, the species responsible, the brown tree snake, dangled from the trees in medusan splendor. A predeparture investigation revealed additional environmental tragedies such as numerous other invasive species, arson fires, a rapidly degrading coral reef ecosystem, and fisheries depleted beyond restoration.

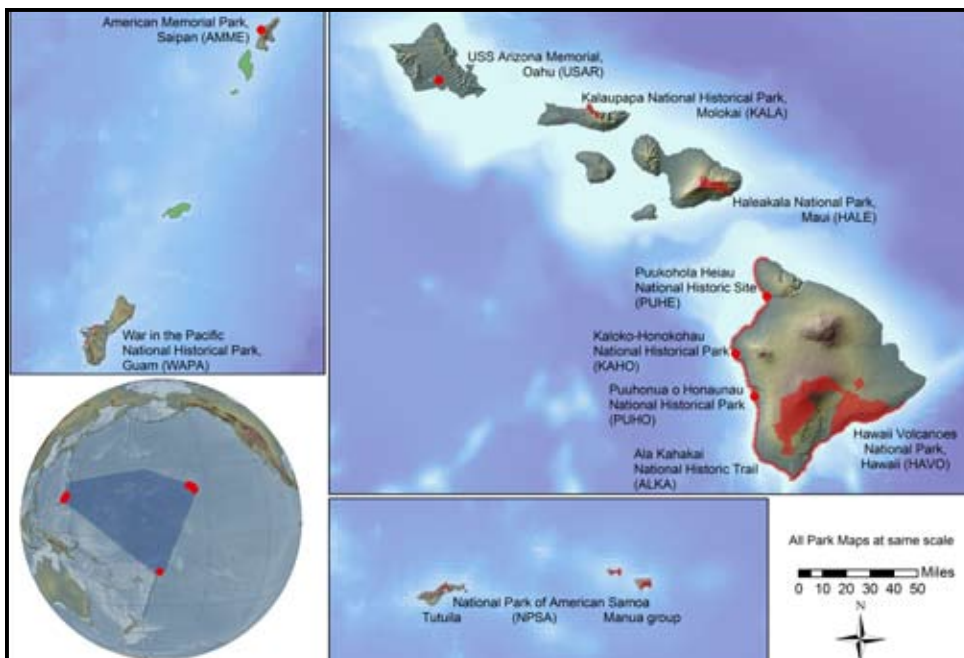
Happily, my new home has shown itself to be much more than a pre-supposed environmental disaster. The island of Guam is one of a beautiful string of pearls that crosses the

seascape of Micronesia. Guam is amply blessed with a rich cultural legacy and spectacular natural beauty.

WAPA is known primarily for its memorials commemorating the battles of the Pacific theater during World War II. What is not widely known, particularly

among the island residents, is that WAPA has one of the highest rates of species diversification in the national park system. Within only 2,000 acres there are coral reefs, limestone forests, wetlands, a mahogany forest, and tropical savannah ecosystems.

The Inventory and Monitoring program (I&M) is important to all park units, but is especially important to small parks like WAPA. I&M data can be transferred into proactive "on the ground" management decisions. For example, data collected in a park on the effect of the sediment rate on the coastal coral reef can be used by the a park superintendent to implement change. This can occur directly through restoration efforts and, more importantly, through outreach in the schools and the community.

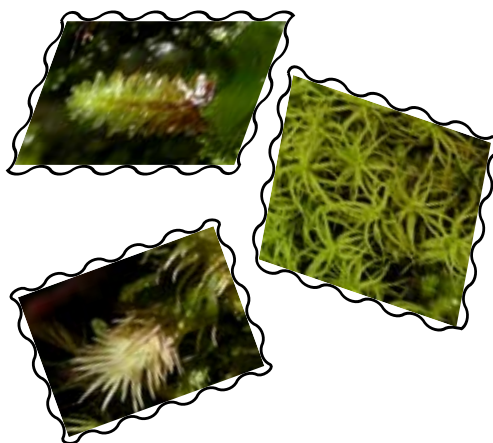


Map of the 11 Pacific Island Network park units.



# Inventories – Making the Most of Moss

Despite the wealth of botanical research at Hawai'i Volcanoes National Park (HAVO) few botanists have collected mosses, and as a result no comprehensive list of the mosses of the park was available. This is no longer the case. With funding from the HAVO Resources Management Division and the PACN, an inventory of mosses at HAVO was conducted. A checklist of park mosses was compiled from various documents and publications, and from specimens housed at the park herbarium and the Bishop Museum. Current names, old synonyms, and voucher information from both the herbarium and Bishop Museum were entered into the National Park Service biodiversity database (NPSpecies). Field surveys were conducted in the specialized habitats of geothermal features and lava tube entrances to search for new moss species. Two preliminary surveys were also conducted in the new Kahuku unit. One hundred thirteen taxa (110 species, one subspecies, and two varieties) are on the current checklist of species found within or near the park boundaries. Six of



*Distichophyllum freycinetii* (top), *Leucobryum seemannii* (lower left), and *Pseudosymplepharis angustata* (right).

these species are invasive or potentially invasive species warranting management consideration. In total, 43 percent of all moss species in the Hawaiian Islands are represented in the park. The results of this inventory will soon be published in the Pacific Cooperative Studies Unit Technical Report series. The report will include many color photographs so that the amateur moss enthusiast may also identify them.

## Data Management – Using GIS to Analyze Environmental Changes

According to ESRI, "a Geographic Information System (GIS) is a collection of computer hardware, software, and geographic data for capturing, managing, analyzing, and displaying all forms of geographically referenced information." Now, let's break that sentence down. ESRI is Environmental Systems Research Institute, responsible for the ArcGIS line of software. And by *geographic data*, we mean information that describes features on the earth's surface.










At this point you might ask "So, what?" Hold on - we're just getting to the interesting part. Did you know that GIS can store both the location and a variety of attributes for each mapped feature? That's what we mean by geographically referenced information. These attributes can include descriptive information such as soil type, elevation, coverage, rainfall, etc. It is the link between the geographic location of a feature and attribute data describing that feature which provides the ability to analyze and overlay resource information in ways that can't be done with paper maps and tabular

databases alone. For example, the I&M program uses GIS to integrate data from a variety of sources such as aerial photos, satellite imagery, hydrology, soils, climate, and data collected in the field with Global Positioning Systems (GPS) in order to analyze changes over time and to model a species habitat.

In a more specific example, the Landscape dynamics protocol will utilize both GIS and remote sensing technology to monitor land use and land cover changes within the watersheds and wildland-urban interfaces of the Pacific island parks. There are few landscapes remaining on the Earth's surface that have not been or are not being significantly altered by humans, fire, alien species infestations, or natural disasters. Thus, land use and land cover change have become important sources of information for managing natural resources and monitoring environmental change. Alterations in land use, as well

# Field tips

**9 tips to reduce the spread of unwanted plants and animals while doing fieldwork.**

-  Always use clean gear and clothes in field. Clean promptly after fieldwork.
-  Maintain clean vehicles.
-  Strategically plan fieldwork to move from non-weedy areas to weedy areas.
-  Dispose of invasive plants & seeds properly.
-  Pack extra clothes.
-  Pack out what you pack in.
-  Arrange for rest breaks in weed-free sites.
-  Report sightings of invasive species populations to resource managers.
-  Clean gear and vehicles in a designated site which can be monitored.

as the intensity of that use, have the potential of being correlated with all PACN Vital Signs monitoring protocols. Products from the Landscape dynamics protocol will include maps showing land cover (forest, woodland, grassland, shrubland, and sparse vegetation) and land use (agriculture, industrial, residential, and number of roads), as well as acreage calculations on the types of changes that have occurred within a 5-10 year period. This information will be essential to park managers interested in mitigating the impact of land use changes on soil erosion and water quality (see Critical Issue on page 7).

If your project could benefit from GIS and would like access to software, data, or training, please contact Viet Doan or Sandy Margriter.

# Monitoring

One down, seventeen to go. Vital Sign monitoring protocols that is.

In July 2006, the Benthic Marine Community Vital Sign protocol was submitted for formal external peer review. Pending receipt of reviewer comments and subsequent protocol revisions, this will be the PACN's first complete protocol. As the many authors discovered during the arduous authoring sessions there was, at-that-time, no complete, fully-approved Vital Sign protocol in the PACN.

This factor led to certain challenges for the Vital Sign protocol development team. One of the more challenging discussions and decisions made by the benthic marine protocol authors was recommending a degree of monitoring intensity and logistical integration with other Vital Signs and partner monitoring efforts. The

network emphasized logistics early in network development, and now these early efforts prove valuable for protocol development. Partnerships and information sharing are also key concepts to overcoming challenges in the Vital Signs monitoring program.

In another example of addressing a challenge, from a practical perspective, the benthic marine protocol identifies modular, or 'park-optional' standard operating procedures (SOPs). These will allow annual efforts to be tailored based on funding and support, while maintaining a core consistency to the protocol.

A complete Vital Sign protocol includes: (1) a protocol narrative, (2) a set of standard SOPs, and (3) supplementary materials including databases, software, maps, and other materials. Not only must the protocol narrative meet na-

competed to catch lupe using long-handled nets from massive stone platforms called tia seuupe (star-mounds). We were also told that different villages favored different animals. For example, residents from Vatia, Tutuila, hunted fua'ō, the brown booby (*Sula leucogaster*) on the nearby sea cliffs, and the fua'ō is the village symbol.

During fruit bat surveys we observed both species (*Pteropus samoensis* or pe'a vao; and *P. tonganus* or pe'a fanua), and found a new roost site in the Tutuila park unit. We were told that during periods of famine (e.g., after hurricanes) fruit bats come into the villages and plantations to feed.

Modified MP3 players with microphones, the same instruments used by the National Park Service's Natural Sounds Program, were also deployed to record the presence of nocturnal seabirds on Tutuila and Tau. Audio recordings failed to detect any seabirds. However, we obtained recordings of insects and several land birds. One remarkable land bird sighting was the blue-crowned lory (*Vini australis*) on the village side of Afono pass, Tutuila. This species is abundant in the Manua Islands, but usually absent from Tutuila.

We did not detect the sheath-tailed bat during 50+ hours of surveys using echolocation bat detectors. Although these surveys are not conclusive, the sheath-tailed bats appear to have vacated portions of American Samoa; as we did each time we caught scent of the tuna canneries.

— Rick Camp

*Be part of the action! Let us know of topics or material you think we should include.*

tional content and style standards, but there are also standards for many SOPs and supplementary materials such as relational databases. For these and other reasons, the NPS-wide Vital Sign Monitoring Protocol Database (<http://science.nature.nps.gov/im/monitor/protocoldb.cfm>) has many examples upon which we can build our 17 remaining protocols.

Now that the Benthic Marine Community Vital Sign protocol is near completion, the other Vital Signs protocol development teams will be able to reap the benefits of the precedents that are being set within the PACN. As a result, we will be much better prepared to help guide all facets of the remaining 17 protocols.

## Notes from the Field

**"FISHY WHIFFS"**, the ultra pungent stench of tuna, rose on the updrafts from Pago Pago Harbor (pronounced pah-n-go) intoxicating bats, birds and biologists alike. American Samoa is home to 1 species of insectivorous bat, 2 fruit bats, 9 shore and water birds, 22 land birds, and 28 seabirds; and the largest tuna canneries in the world. PACN staff L. HaySmith, D. Hu, G. Ackerman, H. Fraser, and myself trekked about the National Park of American Samoa to conduct reconnaissance for monitoring fruit bats, seabirds, and land birds. In addition, we conducted an inventory survey for the sheath-tailed bat (*Emballonura semicaudata*).

Local Samoan knowledge helped us locate fruit bat roosts and flyways, and explain the cultural importance of many land and seabirds. For example, the lupe, or Pacific pigeon (*Ducula pacifica*), was traditionally hunted as a food source. Village chiefs



Mr. Mauga tells us about Tau, bats, and birds.  
Photo by M. Hart

## Featured Staff

**Tahzay Jones, PhD.**

**NPS Pacific Island Network Aquatic Ecologist**

The newest member of the PACN team is Aquatic Ecologist Tahzay Jones, who is happy to have joined the I&M ranks in the Pacific islands. Tahzay earned his PhD. in marine biology and fisheries from the University of Miami, FL. His studies focused on coastal ecosystems, water quality, and various ecological indicators. He took these skills with him to the Southwest Alaska Network where he conducted freshwater research and inventories. When asked what his dream job would be if he could be anything in the world and get paid for it, he said, "Ideally I'd be a wandering devil's advocate – but this job would rank pretty high on the list too."



Tahzay at WAPA (above) and NPSA (below) employing his many years of aquatic ecology experience to several monitoring protocols.



# Program Update

**Monitoring Plan:** I&M is putting the finishing touches on the Vital Signs monitoring plan to turn in to the Washington office by September 30. This is an exciting culmination of over four years of hard work by devoted NPS staff and myriad partners and cooperators from all walks of the conservation spectrum. The monitoring plan will soon be available at <http://science.nature.nps.gov/im/units/pacn/monitoring/>.

**Vital Signs:** In July, the Benthic Marine protocol was submitted for peer review. Monitoring is scheduled to commence in October. If all goes well, this protocol will likely serve as a template for other protocols as they are being developed. Many thanks for the great job by the Benthic Marine protocol folks (E. Brown, L. Basch, D. Minton, P. Craig, and R. Daniel).

I&M is planning another statistician meeting with Biometrician David Schneider at HAVO in October. This will be a great opportunity for Vital Signs monitoring protocol teams to gather and discuss statistics and their protocols.

**Cultural Resources:** I&M has had some great opportunities in the realm of cultural resources this Hawaiian summer. We were able to participate in two cultural festivals on Hawai'i Island (PUHO and PUHE). In addition,

Vital Signs staff meetings relating to cultural resources took place at PUHO, AMME, and WAPA. Also, we had a meeting with the Cultural Resources Advisory Council in Honolulu to discuss the partnerships between our programs. The major topic discussed involved compliance issues as the PACN develops and implements monitoring protocols in the individual parks.

**Staffing:** Alison Ainsworth has joined I&M as a CESU cooperator working on the various plant protocols.

**Data News:** A Microsoft Access and GIS training took place at HAVO for those I&Mers who are charged with developing and maintaining our priceless databases.

**Regional Meetings:** Three PACN I&Mers went to the regional I&M meetings in Idaho and have since returned with fresh ideas for the program.

**Hawaiian Conservation Conference:** Several I&M staffers and cooperators attended this large and informative conservation conference in Honolulu this year. I&M fronted two presentations and four posters.

**THE  
NATIONAL  
PARK SERVICE CARES  
FOR THE SPECIAL PLACES  
SAVED BY THE AMERICAN  
PEOPLE SO THAT ALL MAY  
EXPERIENCE OUR  
HERITAGE.**

## Calendar • July - October, 2006

Jun. = Vital Signs monitoring and cultural values meetings held at WAPA, AMME, and PUHO  
 July = Benthic Marine protocol submitted for review  
 July = PACN meets with Cultural Resources Advisory group in Honolulu  
 July = Microsoft Access and GIS training at HAVO  
 July 25 = Monitoring Plan due to Steve Fancy for final review  
 July = Hawaiian Conservation Conference in Honolulu, I&M presents four posters and two presentations  
 Aug. = Staff attended Pacific West Region I&M meeting in Idaho  
 Sept. = Staff presented poster at climate conference in Oregon  
 Sept. 21 = Monitoring plan goes to the printer  
 Sept. 30 = Final version of Monitoring Plan due to WASO  
 Oct. 6 = Annual Administrative Report and Workplan due to PWR  
 Oct. 10-13 = Statistician workshop at HAVO for Vital Signs protocols

## Games Corner

### Name that PACN park!

The Pacific Island Network is comprised of 11 national parks, national historical parks, a national historic site, a national historic trail, and national memorials. Important features of eight of these park units are pictured below. Can you identify the park units?

Answers are below:



1



2



3



4



5



6



7



8

### ANSWERS:

1-Bunker at AMME  
 2-Crater at HALE  
 3-Fishpond wall at KAHO  
 4-Ofu beach at NPSA  
 5-Historic road at PUHO  
 6-Cannon at WAPA  
 7-USS Arizona Memorial at USAR  
 8-View from Kalawao at KALA



## Caves and Lava Tubes – Sanctuary for man and beast

**Description:** Often unnoticed within the Pacific islands, caves and lava tubes are rich sanctuaries containing significant minerals as well as other geological, biological, paleontological, hydrological, and cultural resources.

The Federal Cave Resources Protection Act defines a cave as “any naturally occurring void, cavity, recess, or system of interconnected passages beneath the surface of the earth or within a cliff or ledge, including any cave resource therein, ...” (16 U.S.C. 4301-4310). This definition includes lava tubes, littoral caves, talus caves, and karst features, as well as submerged resources such as sea caves.



*A researcher recording data at the mouth of a lava tube at Hawai'i Volcanoes National Park.*

At Hawai'i Volcanoes National Park (HAVO) for example, there are over 200 known lava tubes (caves). In Hawaii, lava tubes represent not only an important geologic resource for investigating ongoing geologic processes, but also serve as habitat for rare species such as the small-eyed, big-eyed hunting spider (*Lycosa howarthi*). Many caves are sites of spectacular archeological treasures, and continue to serve an important role in Hawaiian culture. In Guam, karst caves etched by water running through the limestone terrain may be found both on land and submerged in ocean areas.

**Cultural Significance:** Caves have long been important places for native peoples. Shelter, water catchments, places of refuge in times of war, sites of religious ceremony, burial places, and travel corridors are just a few of the many human uses that continue to the present. While cultural practices vary throughout the Pacific islands, caves share a common theme as reservoirs of cultural heritage.

In one example, Hawaiian kupuna (elders) tell stories of using caves as sites for weaving lau-hala mats, where the moist air of the cave kept the lauhalas supple throughout the dry heat of the day.

**Inventories:** Cave inventories are on-going in HAVO and are planned for several other Pacific island parks. Building upon the data collected through the years of work of many dedicated individuals, the NPS is developing databases of all known cave entrance locations. Efforts such as mapping selected cave passages, assessing the cultural and natural resources within selected caves, and identifying sites of particular cultural or biologic significance for enhanced resource protection are also priorities.

**Monitoring:** Limited cave monitoring is ongoing on a park-by-park basis as determined by individual park needs. Current cave monitoring ranges from human impacts and cultural resources to air quality and invertebrates.

**Status & Trends:** Cave resources are exceedingly fragile, with even a single visit impacting cave air quality, geological and archeological features, and biota. Looting and recreational caving can destroy non-renewable archeological and biological resources. Habitat features, like 'ōhi'a (*Metrosideros polymorpha*) tree roots that provide nutrients to certain cave species are impacted by habitat loss, alien species, fires, human access and trampling,

and altered nutrient cycles. Even ongoing lava flows that continue to create new lava tubes can destroy old ones.

**Management:** The protection and preservation of cave resources and associated values is of primary concern to managers. These goals are supported through public safety efforts, archeological conservation, permitted scientific research, and stewardship of cultural heritage. Management priorities include completing cave entrance inventories, establishing an integrated monitoring program, and sustaining the permit and registration process for cave use.

To protect cave resources, the objects within them, and for human safety, National Park Service policy in all Pacific island national parks is to prohibit public entry unless otherwise authorized. Currently, the only cave or lava tube open to the public is Thurston Lava Tube (Nāhuku) at HAVO. Your cooperation and respect for these sensitive resources is highly valued.

— J. Moniz-Nakamura and F. Klasner

### For more information:

NPS Cave & Karst Program:

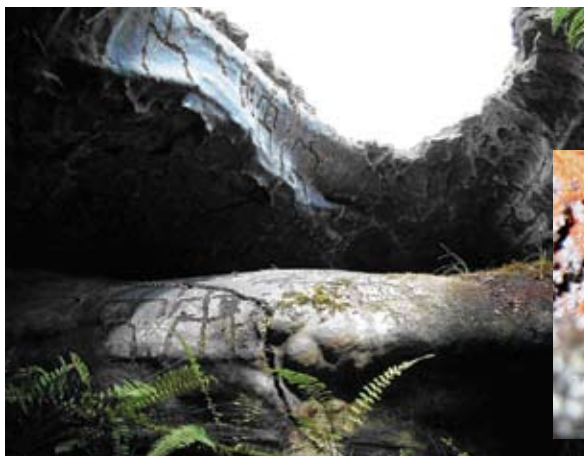
<http://www2.nature.nps.gov/geology/caves/>

National Cave and Karst Research Institute:

<http://www2.nature.nps.gov/nckri/>

National Speleological Society:

<http://www.caves.org/>



**Left:** Petroglyphs at lava tube entrance at Hawai'i Volcanoes National Park.

**Bottom-right:** Cave-adapted small-eyed, big-eyed hunting spider (*Lycosa howarthi*).







## Erosion and Sedimentation — Scourge of the reef

**Background & Description:** Upland erosion and associated coastal sedimentation are significant threats to the terrestrial and aquatic resources of many Pacific Island Network (PACN) parks. This is particularly true at War in the Pacific National Historical Park (WAPA), Kalaupapa National Historical Park (KALA), and Pu‘uhonua o Hōnaunau National Historical Park (PUHO). Tropical soils are thin and generally of poor quality. When vegetation is removed for farming or development, there remains little natural protection for the land as rain and wind remove topsoil, which in turn can alter the overlying plant community. Lost soil is transported down the watershed and can clog streams, altering streambed quality and adversely affecting aquatic organisms, including many rare or endemic species of fish and snails. Stream sediments can also impact human health, especially on islands that rely on streams for drinking water. Soil eventually is flushed from streams onto coastal coral reefs, where it buries corals and degrades water quality. Several international conservation agencies have identified sedimentation as a primary threat to Pacific coral reefs.

Erosion and sedimentation are, however, natural processes on Pacific islands. Coral reef distributions reflect naturally high sediment loads near river mouths, where reef flats are “cut”, or in some cases, do not exist. However, human activity has altered this process. Poorly regulated human development, poor land management practices (particularly associated with



A sediment plume washes onto the Reef at War in the Pacific NHP following a storm in August 2004.

agriculture and wetlands preservation), and wildland fire all contribute to increased erosion and coastal sedimentation.

**Occurrence in Pacific Island Network:** Erosion and sedimentation are a significant problem in several PACN parks. The worst case is at War in the Pacific NHP where the link between wildfire arson, vegetation changes, erosion, and sedimentation have been studied since 2002. At WAPA, declining soil quantity and quality have been attributed to changes in tropical savanna vegetation communities, including the development of “badlands” or areas where all top soil has been entirely lost leaving exposed acidic clays that erode at a rate in excess of 370 tons/acre/year (and possibly as high as 2,500 tons/acre/year). In the waters at WAPA, sedimentation rates are among the highest in the world for a coastal coral reef ecosystem. At the park, coral recruitment, or the settlement and survival of juvenile corals, is among the lowest in the world, and appears to be part of a trend of declining coral recruitment observed across Guam over the last thirty years. During this time period coastal sedimentation has doubled. While the cause of these low recruitment rates has not been established, they may be linked to elevated sediment levels.

Erosion and sedimentation are also known to be a significant problem at KALA (and on Moloka‘i in general) and at PUHO on Hawai‘i Island, where eroded sediments are impacting both natural and cultural resources.

**Management Considerations:** Reducing the impacts of erosion and coastal sedimentation is not a simple endeavor. Standard methods such as catchment basins are often expensive, technically challenging, and sel-

dom address the ultimate cause. Detailed studies are needed to pinpoint the cause and source of soil loss, so that lasting, long-term solutions can be achieved. In most cases this will require changes in the way people conduct business in the islands. Many human sources of upland erosion occur outside park boundaries, requiring the NPS to work cooperatively with adjacent land owners and local governments to elicit change.



An NPS diver collects marine benthic data at War in the Pacific NHP as part of an on-going sedimentation study.

On Guam, human activities contributing to soil loss include poor land management, inadequate construction practices, and arson. Finding environmentally friendly yet economically viable alternatives to current practices is a challenge, but successfully addressing these human sources could substantially reduce soil loss and sedimentation on Guam. Similar results may be achievable on other islands where erosion and sedimentation threaten natural resources.

The PACN I&M program will be monitoring erosion and deposition as one of its network Vital Signs. This information will be critical to determine the success of erosion and sediment mitigation efforts, and will provide important information to park managers when working with adjacent landowners.

— D. Minton



An NPS diver (right) fans a coral reef in War in the Pacific NHP to show the sediments that have settled on and killed the corals at this site in the park. In the picture on the left, the corals in the lower left corner are dead; those in the upper right are partially dead.



## Kalaupapa National Historical Park — Molokaʻi

**History:** In 1865, King Kamehameha V signed the “Act to Prevent the Spread of Leprosy” to officially recognize the concern in the Hawaiian Kingdom. As part of the act, the most advanced and incurable cases were exiled to the island of Molokaʻi where a leprosy settlement was established on the Kalaupapa peninsula. Through the heroic efforts of Father Damien DeVeuster and others, the patients’ lives were transformed as they were treated with dignity and respect. Then in the 1940’s a sound treatment for Hansen’s disease (leprosy) was discovered. Finally, in 1969 the state abolished the isolation law which allowed patients to move freely from the peninsula. Kalaupapa National Historical Park (KALA) preserves the historic Kalaupapa settlement, community, and the current lifestyle of the remaining Hansen’s disease patients. The Kalaupapa Leprosy Settlement is a landmark on the National Register of Historic Places.

**Cultural Resources:** The park’s most significant cultural resource is the Hansen’s disease patients, who continue to live in Kalaupapa. Their presence and knowledge make this park unique in the national park system. There are 400 homes, churches, and other structures which interpret the history of the settlements and serve as a tangible reminder of life at Kalaupapa. Looking further back, archeological remains, including the stone ruins of ancient temple sites and terrace walls, provide clues to the history of the native Hawaiians who lived on the peninsula and in the valleys before the area became a Hansen’s disease settlement.

**Natural Resources:** Located on the north shore of Molokaʻi, KALA is roughly 10,800 acres encompassing a wide variety of habitats from submerged, marine resources (2,000 acres) to lowland coastal, mesic, and rainforest habitats. The park includes dramatic cliffs, intervening valleys, lava tubes, caves, and more. KALA’s offshore islands are considered one of the premier undisturbed natural resources of Hawaii due to the presence of seabird colonies, rare plants, and invertebrates. Kauhakō Crater in the center of the peninsula, rises to 402 feet above sea level, and has a crater lake over 800

feet deep. Kauhakō lake contains an endemic sub-species of shrimp (*Paleomon debilis*) and an unusual microbial fauna. Nearly 20 federally-listed threatened and endangered species of plants (e.g., Dwarf naupaka, *Scaevola coriacea*) and animals (e.g., Humpback whale, *Megaptera novaeangliae*) have been identified within the park. The perennial Waikolu Stream contains all five native diadromous fish species, native snails, and shrimp. Significant marine resources include threatened and endangered species and well preserved coral reef communities.

### Inventory and Monitoring Highlights:

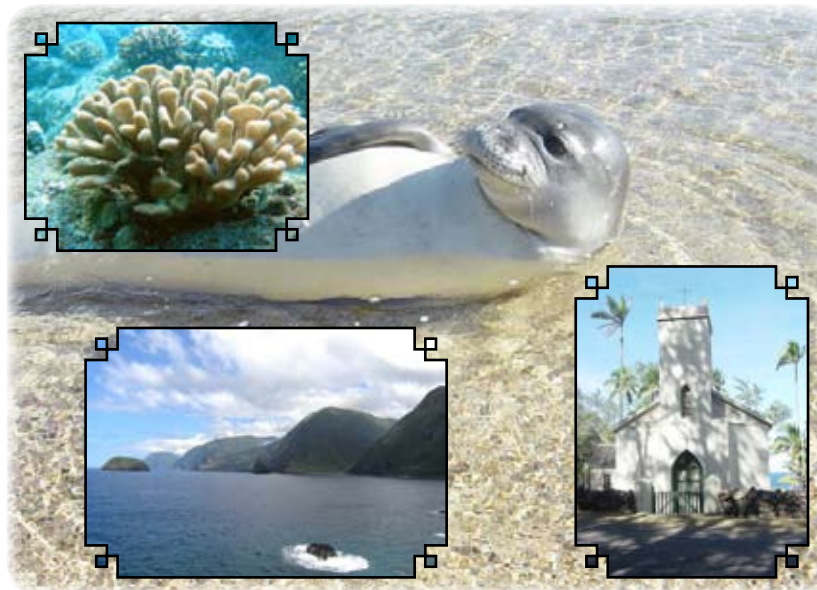
An estimated 90% of the terrestrial plant species within the park have been documented, and in 2005 preliminary marine vegetation surveys were also conducted. Fourteen threatened or endangered plant species were reported in Kalawao County and Okala Island, and others may be found on un-surveyed cliffs. Surveys of the freshwater aquatic fauna in Kauhakō lake and Waikolu Stream have documented endangered species as well. Surveys were also conducted in 2001 and 2003 to identify species of resident and migratory seabirds. The marine vertebrate inventory in 2005 recorded 52% of the known reef and shore fishes in Hawaii. Culturally important intertidal marine invertebrates (e.g., ‘Opihi, *Cellana sp.*) have been monitored since 2003. Currently, the I&M benthic monitoring protocol is monitor-

ing corals and other benthic biota (e.g., algae). Furthermore, the park contains one of the most prevalent birthing sites in the main Hawaiian Islands for the endangered Hawaiian monk seal (*Monachus schauinslandi*).

**Current Issues in Management:** Treatment of encroaching alien vegetation on archeological sites is a major challenge. Natural resource priorities include the removal of feral goats, pigs, and axis deer to protect native vegetation and reduce upland erosion. Alien species (fish, mollusks, and crustaceans) could heavily impact native invertebrates in Kauhakō lake if introduced (as has been documented in Hawaiian anchialine pools). Introduced marine fish and potential invasion of alien algae may threaten native coral reef fauna and flora. Other management issues include water diversion for agriculture and drinking water from Waikolu Stream, overfishing, and seepage of pollutants into the marine ecosystem from the settlement. Measures such as vegetation restoration, fencing, removal of ungulates, exotic plant management, and protecting marine resources are key to preserving KALA’s unique and diverse natural resources. — E. Brown and G. Hughes

### Come visit us:

Access is restricted to boat, air, or a steep foot trail. Visitation averages 76,000 people per year (only guests of residents may stay overnight). On the Web at: <http://www.nps.gov/kala/>



#### From left to right:

Coral (*Pocillopora edyouxi*), Mōkapu and Okala Islands, Saint Philomena Catholic Church in Kalawao.

#### Background:

Young Hawaiian monk seal (*Monachus schauinslandi*).